

# Genetic parameters of novel mid-infrared predicted milk traits in three dual-purpose cattle breeds

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N. GENGLER<sup>1</sup>, H. HAMMAMI<sup>1</sup>**

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# Dual-purpose cattle

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Dual-purpose  
Belgian Blue  
(dpBB)



Montbéliarde  
(MON)



Normande  
(NOR)

# Dual-purpose cattle

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Difficulty in gathering relevant large-scale data in routine

- Small sized cattle populations
- (Organic) pasture based production systems

# Usefulness of mid-infrared spectra (MIR)



*Milk samples*

(milk payment, milk recording)



MIR analysis

FOSS

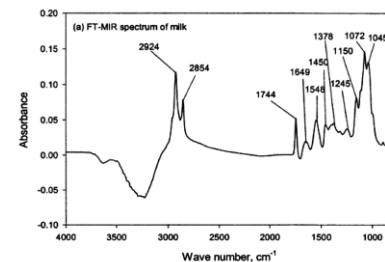


Quantification

Calibration equations



**→ wide range of novel phenotypes !**



Raw data = MIR spectra

# Objectives

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- Genetic parameters of 39 novel MIR predicted milk traits
- How MIR traits can predict longevity at early stages?
- Any help from genomics?

# Data

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	<b>dpBB</b>	<b>MON</b>	<b>NOR</b>
Cows in production	2,988	1,330	621
1 <sup>st</sup> lactation test-day	21,287	10,062	4,637
2 <sup>nd</sup> lactation test-day	11,771	6,716	2,532
3 <sup>rd</sup> lactation test-day	6,246	4,217	1,370
Pedigree	7,744	3,807	2,304

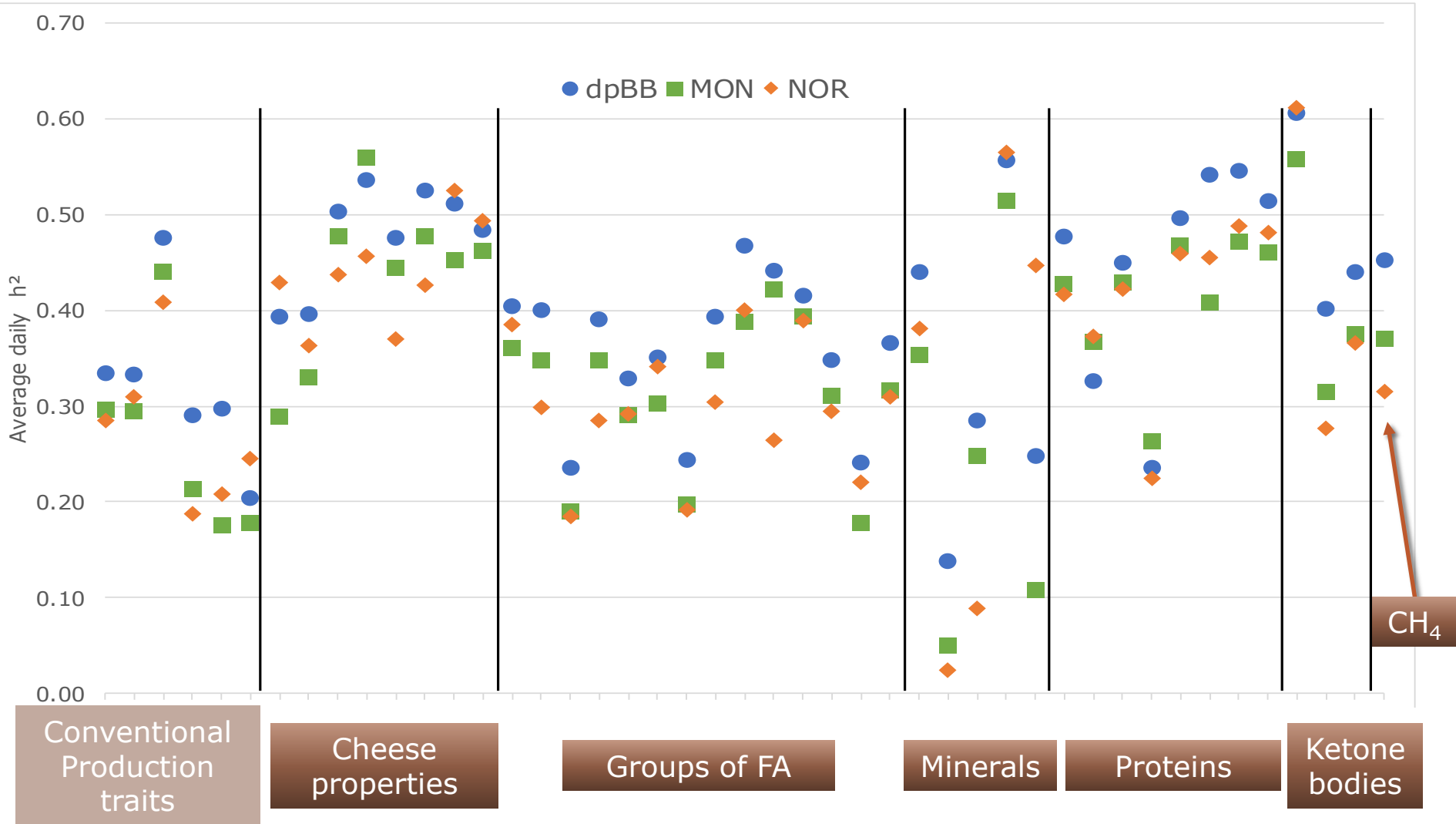
# MIR predicted milk traits

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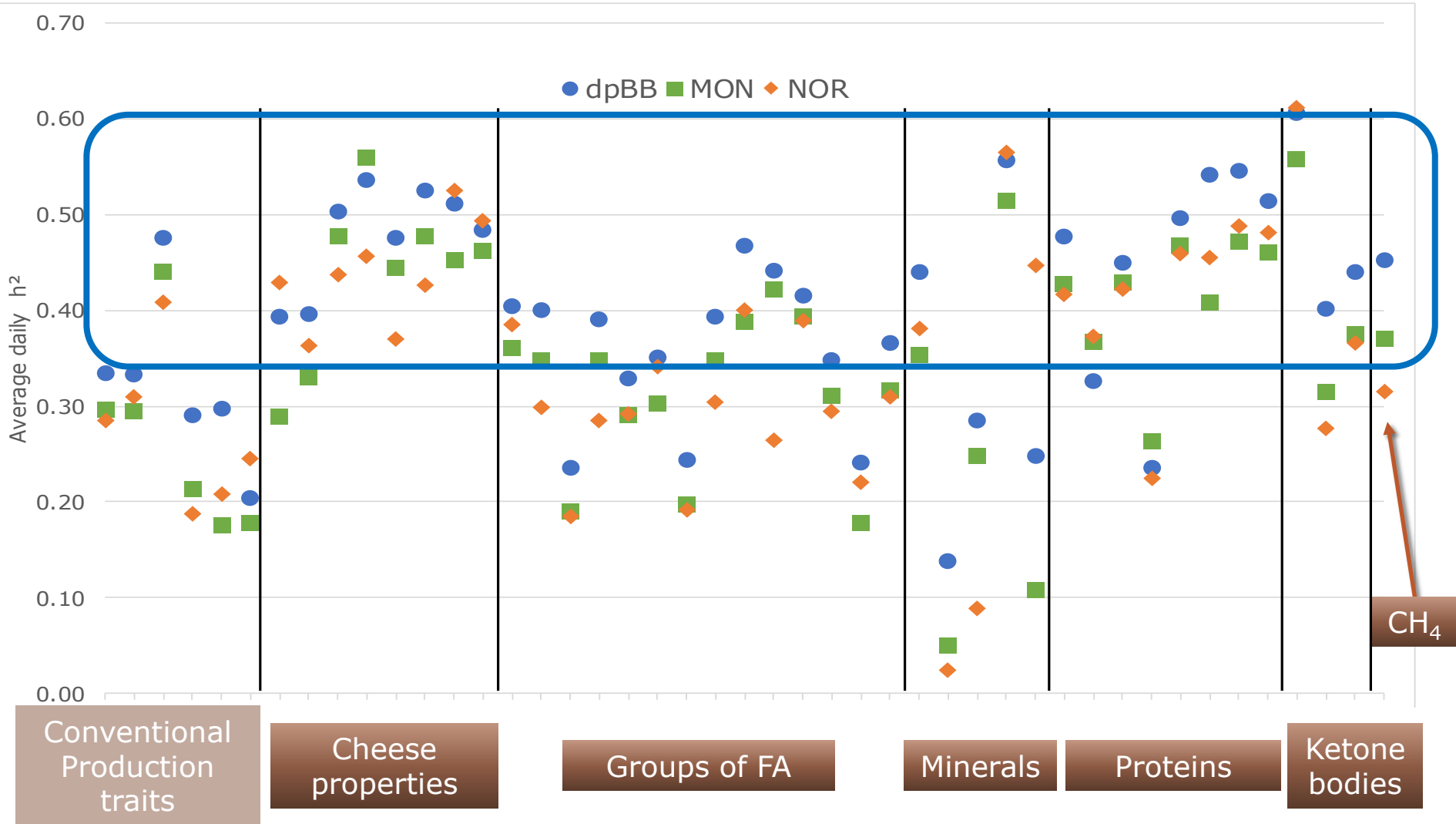
- Cheese properties: 8
- Groups of fatty acids (FA): 14
- Minerals: 5
- Protein components: 8
- Ketone bodies: 3
- Methane (CH<sub>4</sub>)

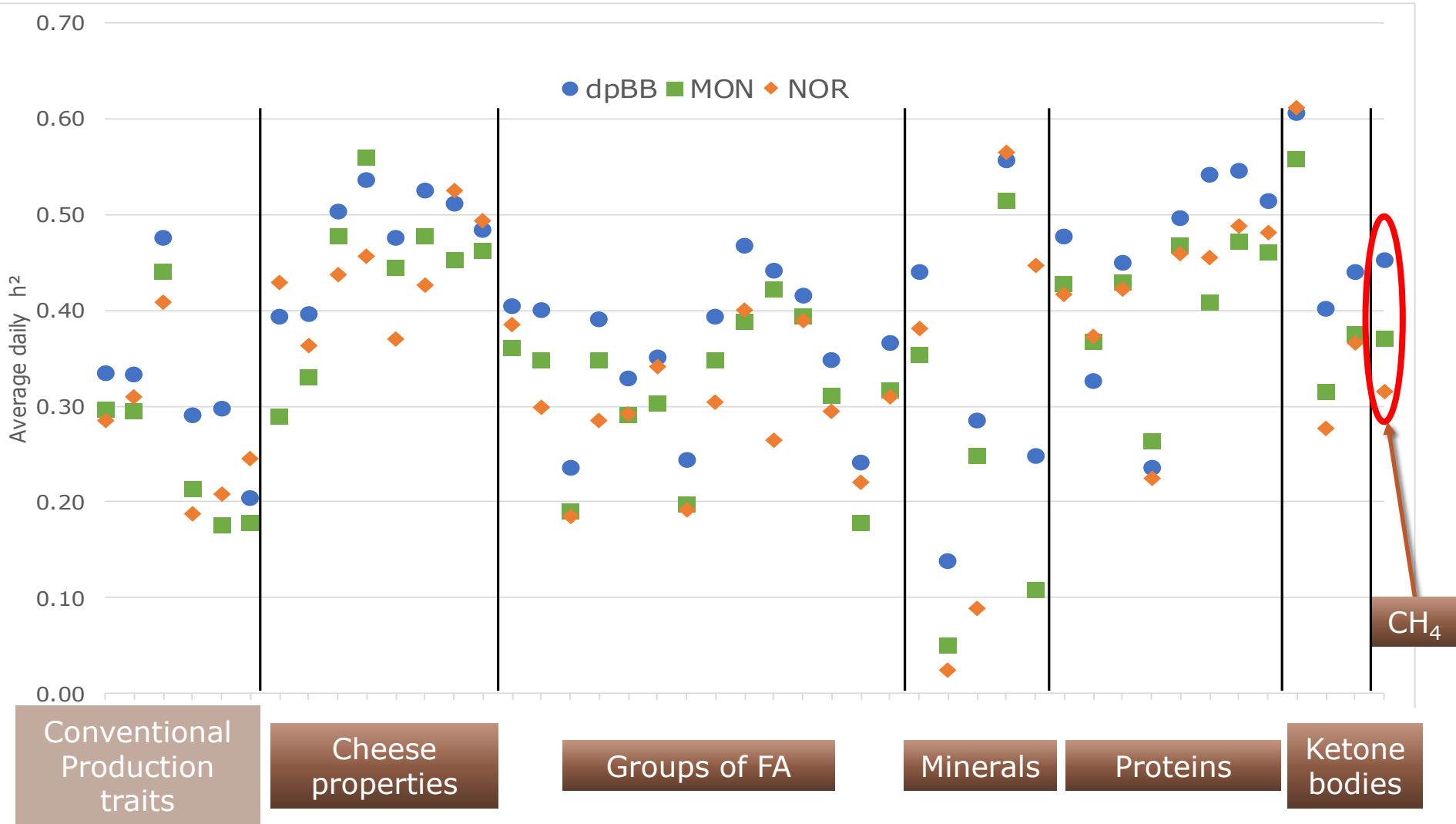


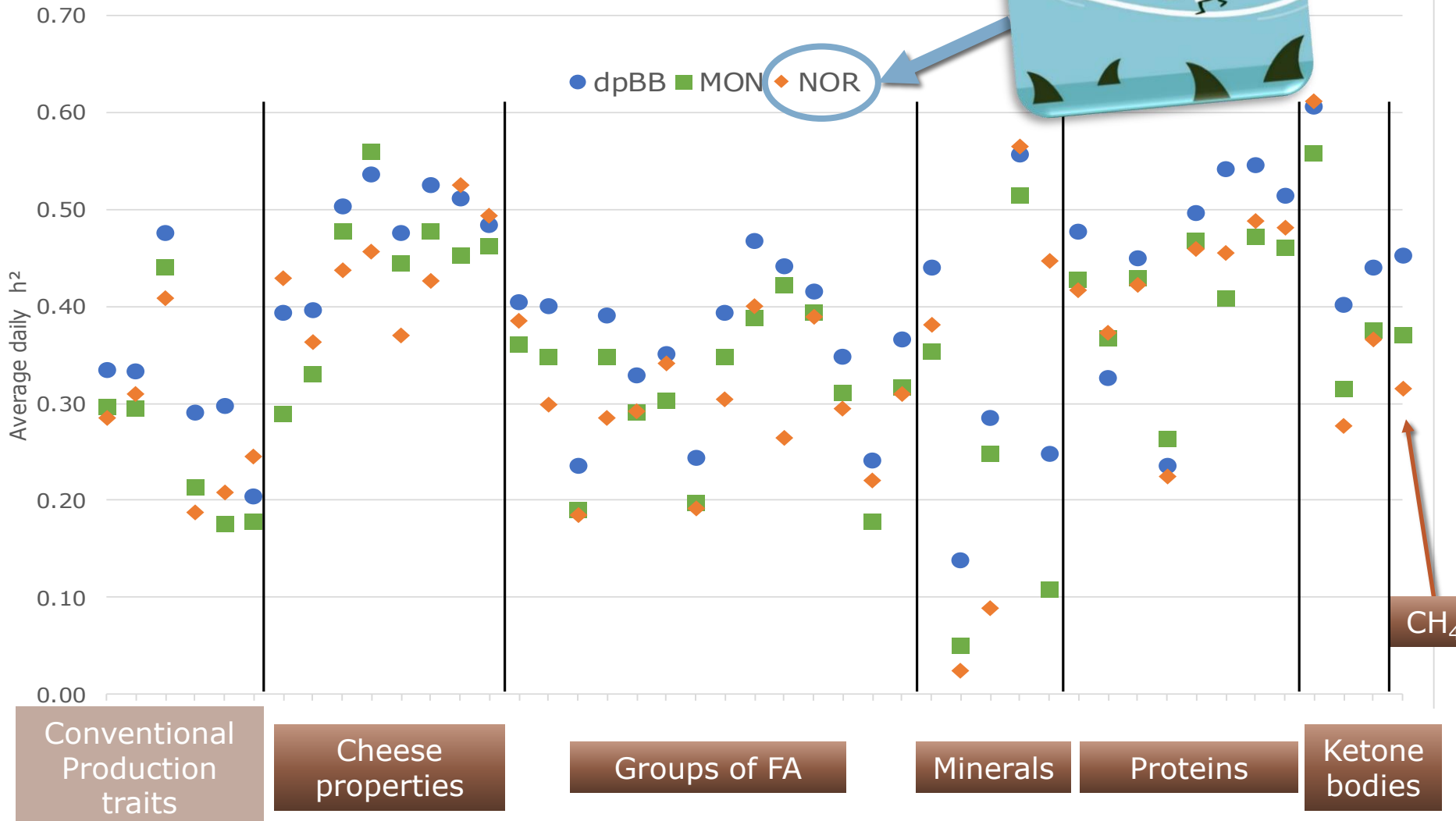
**single-trait  
multi-lactation  
random regression  
test-day model**

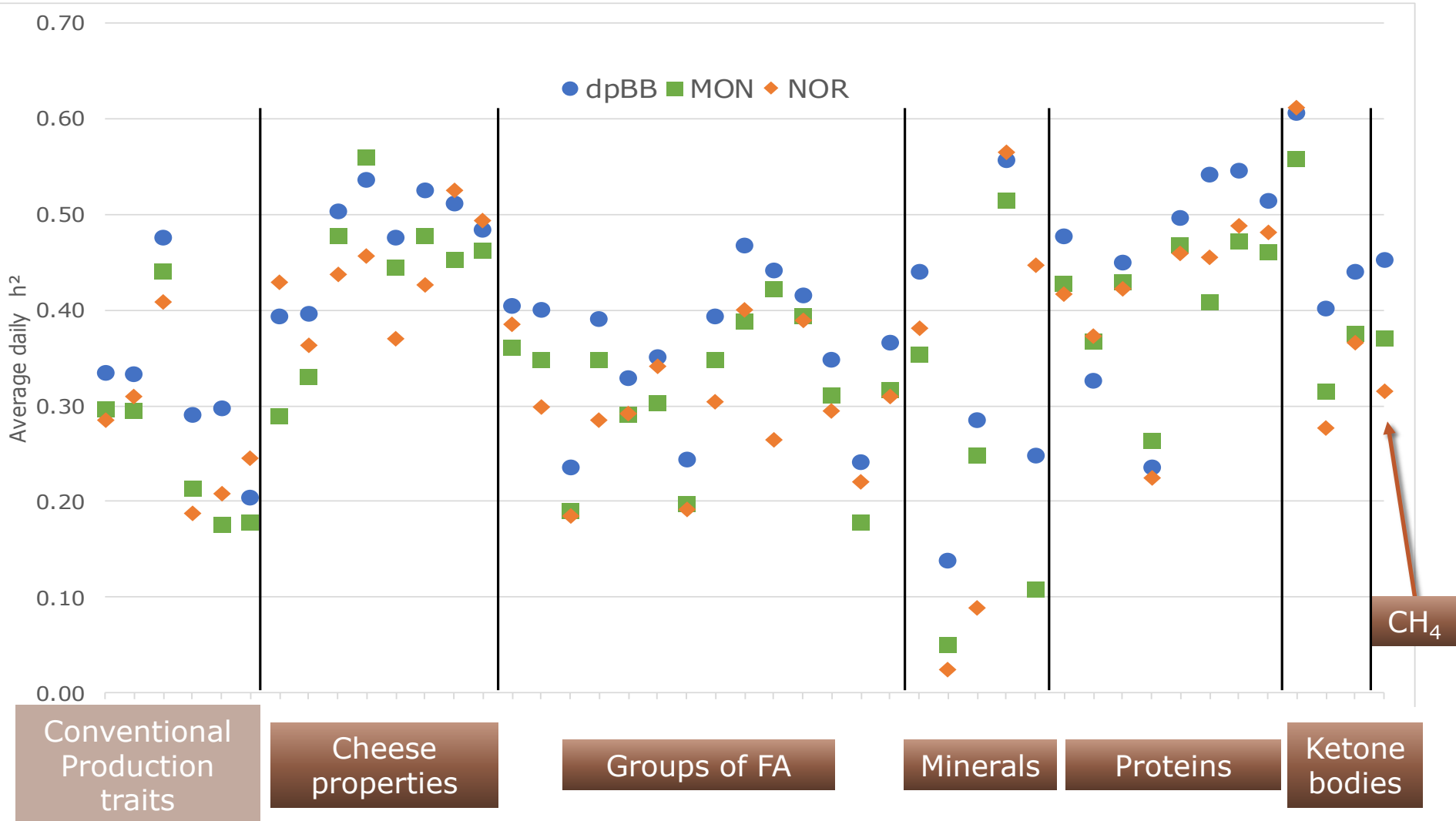












Prediction of  
longevity at early  
stages ?

production &  
novel MIR traits



Prediction of  
longevity at early  
stages ?

EBV & GEBV for  
production &  
novel MIR traits

21,287 test-day  
records



2,988 primiparous  
dpBB cows

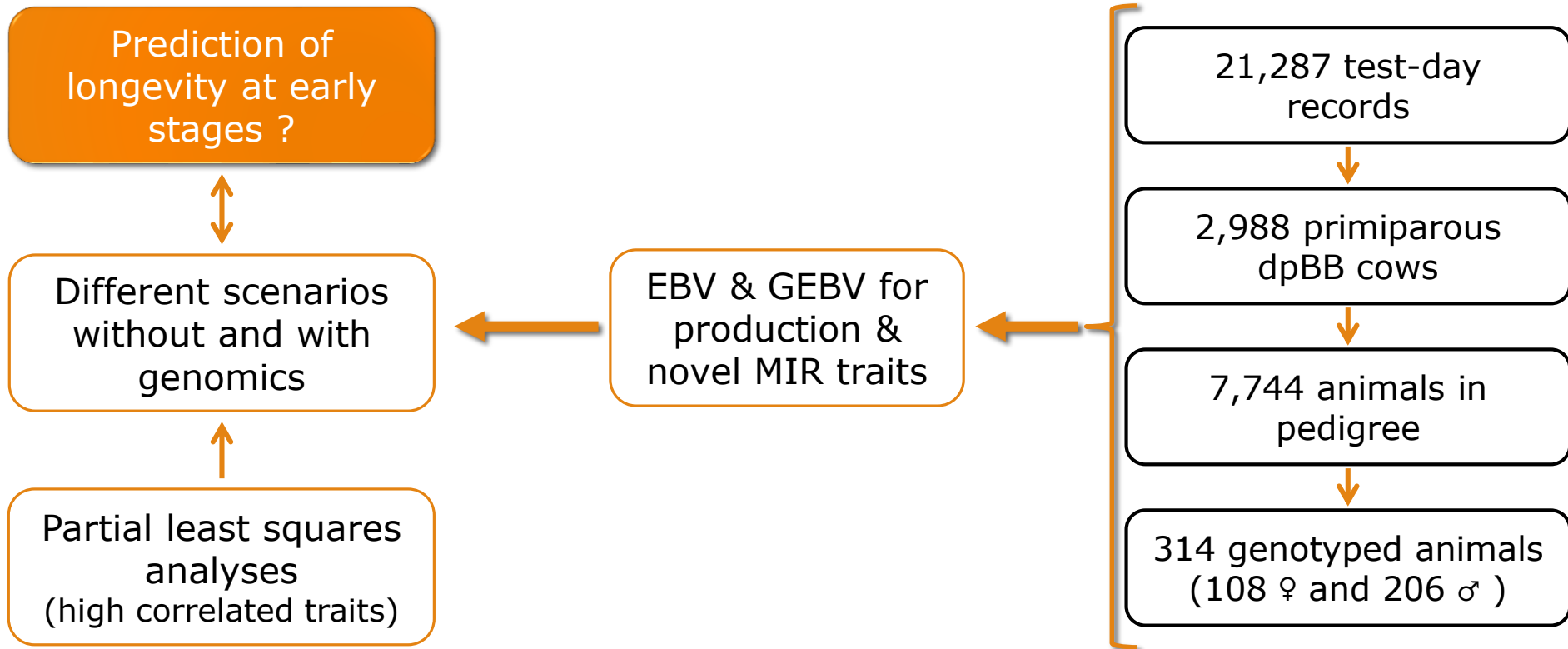


7,744 animals in  
pedigree



314 genotyped animals  
(108 ♀ and 206 ♂ )





# Longevity from MIR traits?

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Scenarios	EBV (r)	GEBV (r)
S <sup>1</sup> : Milk, fat & protein yields	0.25	0.19
S <sup>2</sup> : Acetone, citrates & BHB	0.22	0.37
S <sup>3</sup> : S <sup>1</sup> + S <sup>2</sup>	0.34	0.41
S <sup>4</sup> : S <sup>1</sup> + UFA + SCFA + MCFA	0.42	0.29
S <sup>5</sup> : S <sup>2</sup> + UFA + SCFA + MCFA	0.37	0.42
S <sup>6</sup> : S <sup>3</sup> + UFA + SCFA + MCFA	0.51	0.47


Based on genotyped dpBB bulls with  $\geq 10$  daughters (N=160)



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# Take home messages

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- Novel MIR predicted milk traits for dual-purpose cattle:
  - heritable → selection
  - promising early indicators of longevity (for dpBB)
- Use of genomics:
  - Slight increase of reliabilities (not shown)
  - GEBV for novel MIR traits tend to be better predictors of longevity

**MIR traits ~ useful in 3 dual-purpose cattle breeds**

# Acknowledgements

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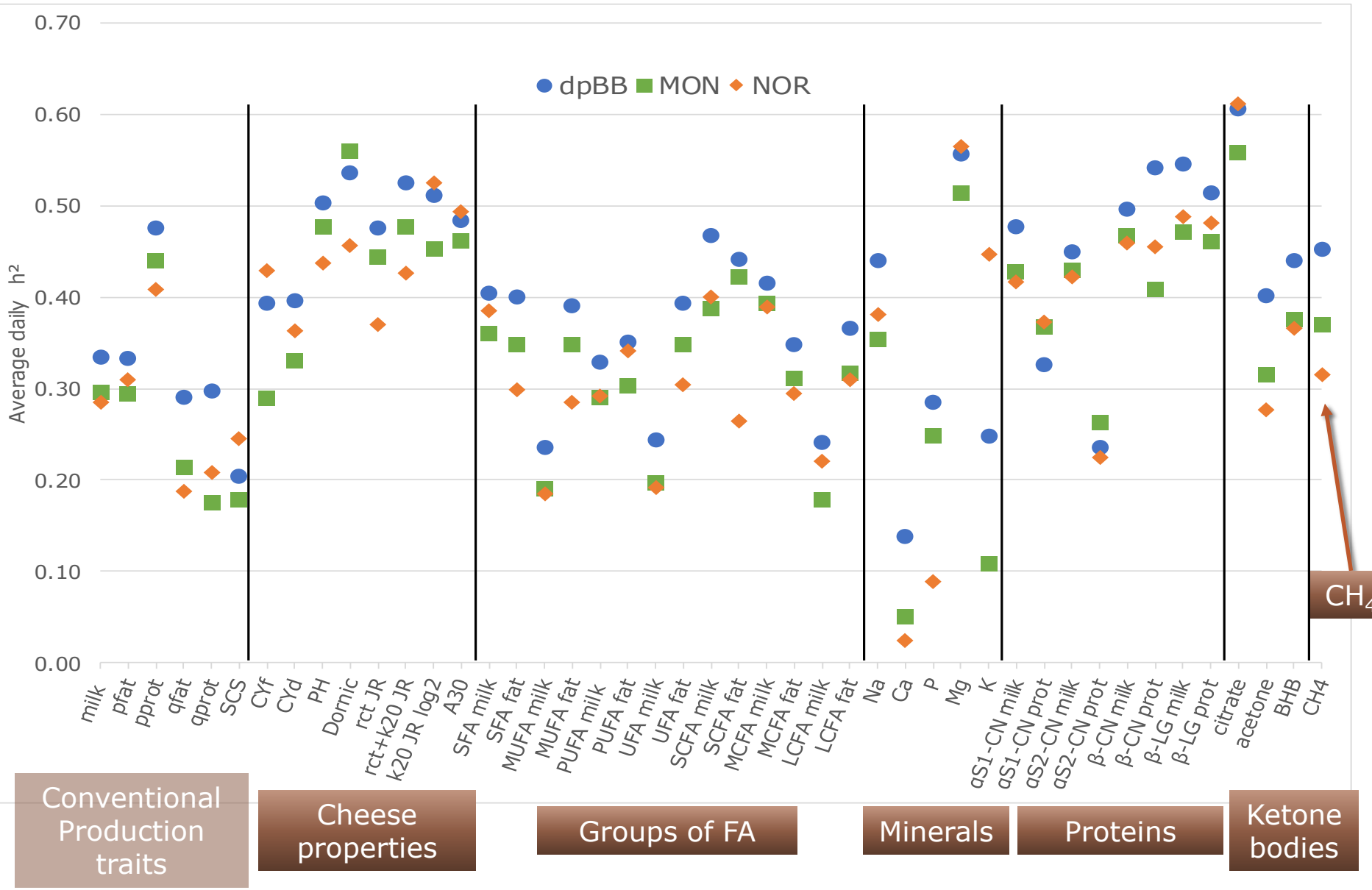
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# R<sup>2</sup> of calibration equation

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	<b>min</b>	<b>max</b>
Cheese properties	0.44	0.78
Groups of FA	0.77	0.99
Minerals	0.44	0.82
Proteins	0.69	0.77
Ketone bodies	0.62	0.89
CH <sub>4</sub>	0.70	